R·I·T

Title: Trion ICP-RIE

Semiconductor & Microsystems
Fabrication Laboratory **Revision**: **B** **Rev Date: 06/02/2020**

Approved by:

_____ / / _____ / /
Process Engineer Equipment Engineer

1 SCOPE

The purpose of this document is to detail the use of the Trion Phantom ICP-RIE. All users are expected to have read and understood this document. It is not a substitute for in-person training on the system and is not sufficient to qualify a user on the system. Failure to follow guidelines in this document may result in loss of privileges.

2 REFERENCE DOCUMENTS

- Material Safety Data Sheets for process gasses
- Appropriate Tool Manuals

3 DEFINITIONS

ESC – Electrostatic Chuck
HV- High Voltage

4 TOOLS AND MATERIALS

4.1 General Description

The Trion ICP-RIE is a single chamber reactive ion etcher with Inductively Coupled Plasma for processing involving SF6, CF4, CHF3 and O2. RIE will etch Nitride, Poly and several metals like moly with fluorine etching. It operates with the electrostatic chuck with helium backside cooling options. The system has a Windows XP based operating system and the latest software available from Trion Technologies. It is not the same as the Trion Minilock, or Phantom RIE and qualification on the other Trion tools does not qualify you on this tool.

5 SAFETY PRECAUTIONS

5.1 Hazards to the Operator

5.1.1 This system uses hazardous gases, high voltages and RF plasma to process wafers. If you have problems operating the system or suspect there is a problem with the

machine, at any time contact a technician (Bruce Tolleson/Rich Battaglia) to correct the problem before continuing.

5.1.2 Mechanical Hazards – There are pinch points on the tool. Lid opens and closes automatically.

5.2 Hazards to the Tool

5.2.1 Wafer size - This tool is only intended for 6" wafers and 6" carriers. See the SMFL process engineer if you are using carriers.

5.2.2 Recipes – Do not edit any recipes that begin with the letters "FAC." These are reserved for the factory class.

5.2.3 Contamination – Do not process wafers with gold or copper on them.

5.2.4 The Electrostatic Chuck must remain contamination free to work properly. Clean the backside of all wafers and carriers before loading.

6 INSTRUCTIONS

6.1 Initial State Check

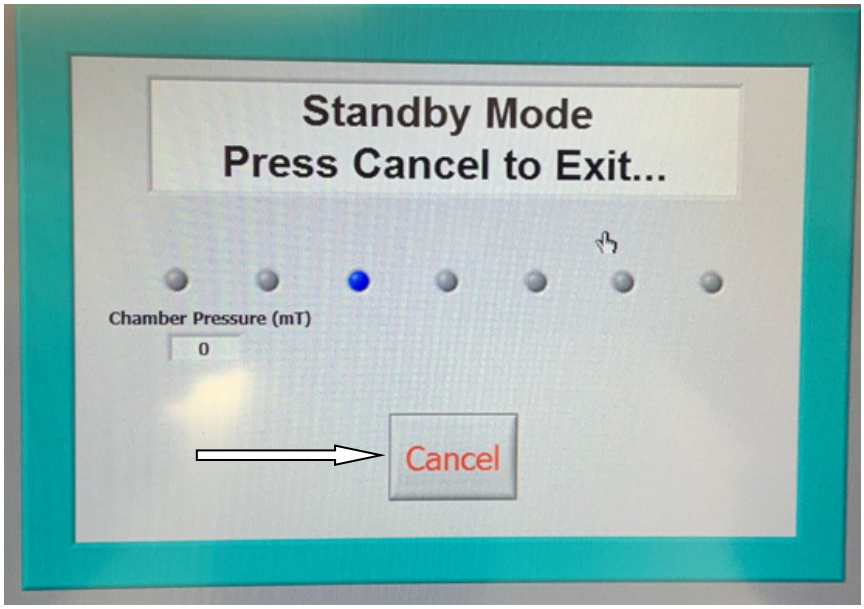
6.1.1 In the service chase #2715, ensure the N_2 manifold (located immediately on your right hand side as you enter the service chase) labeled "Both Trion" is on. The pressure should read at least 15 PSI.

OFF position **ON position**

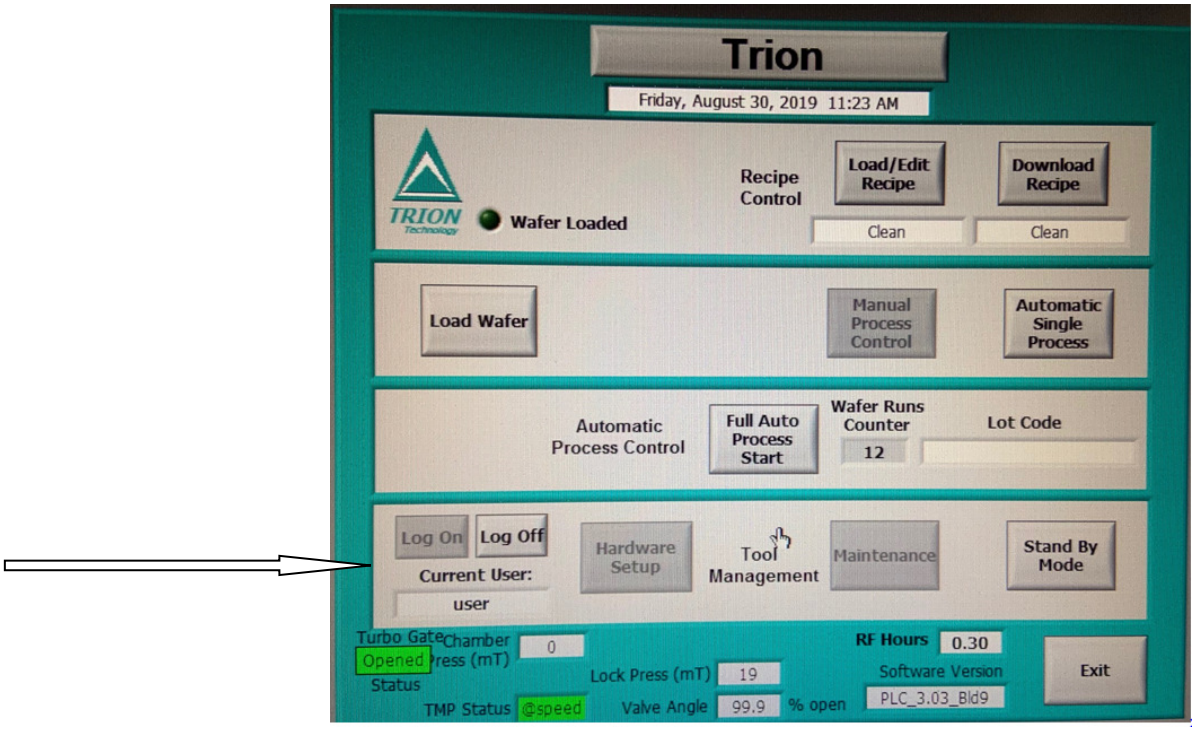
6.1.2 In service chase #2725 ensure the Helium is on labeled Trion ICP on the Helium panel and the panel shows 20PSI.

6.1.3 Make sure that the tool is swiped in on card swipe 1.

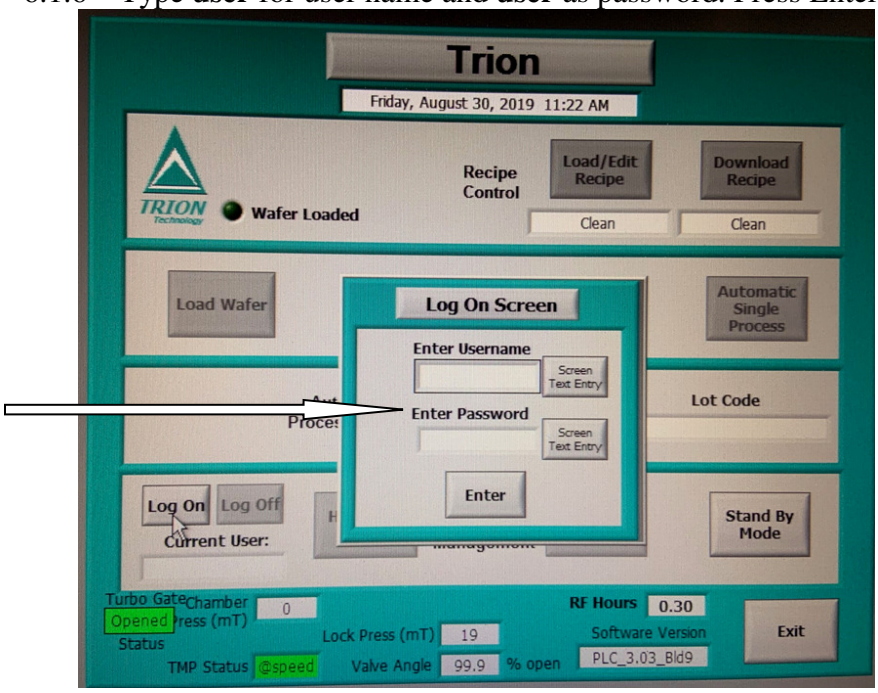
6.1.4 If the computer is in sleep mode touch the screen or press the space bar. This should show STANDBY MODE.



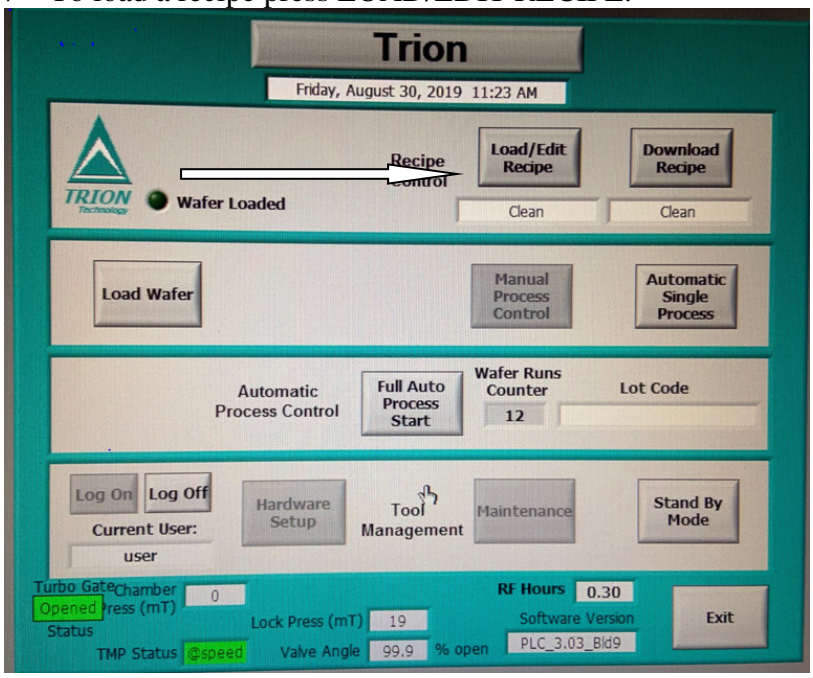
6.1.5 Hit CANCEL. The MAIN Screen should appear. Press LOG ON at the bottom left corner.



6.1.6 Type **user** for user name and **user** as password. Press Enter. This logs you in.



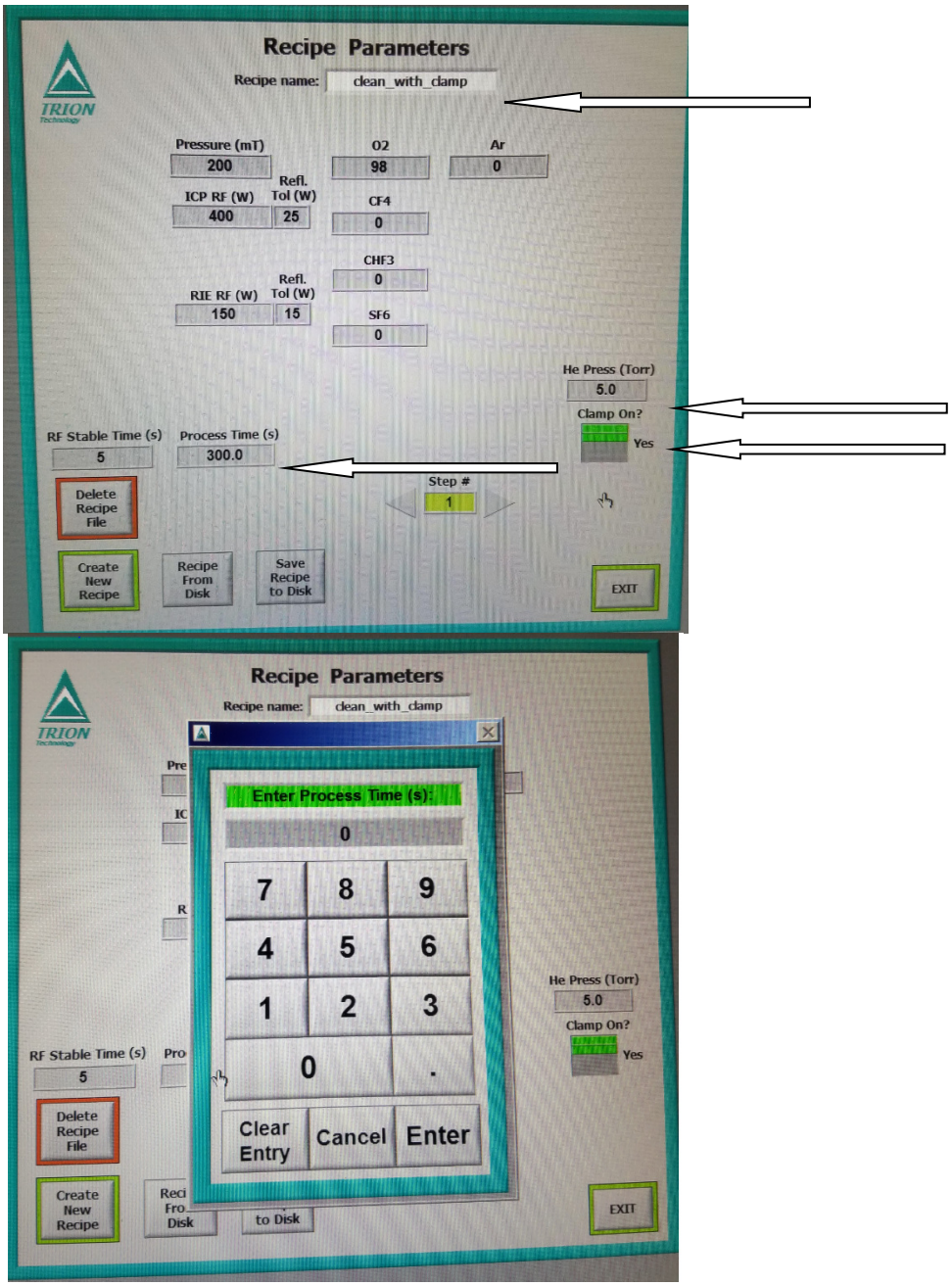
6.1.7 To load a recipe press LOAD/EDIT RECIPE.

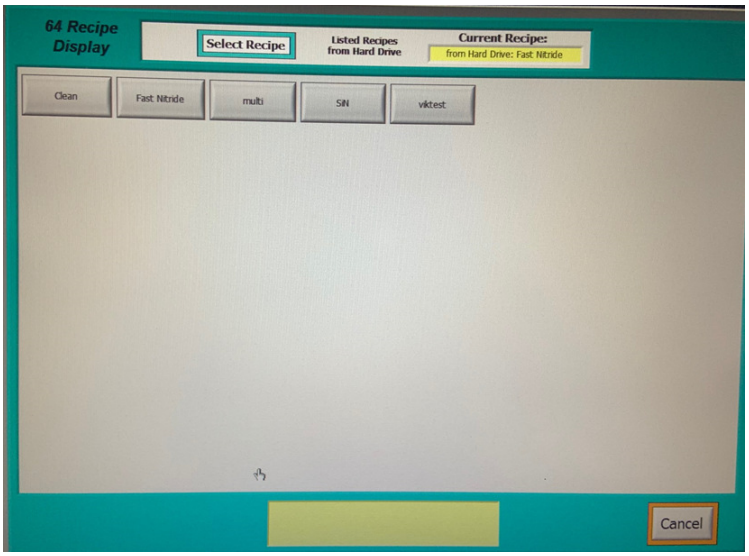


6.1.8 This brings up the RECIPE PARAMENTER screen. Look for the recipe name in the white block at the top of the screen. If this is the recipe you want adjust the

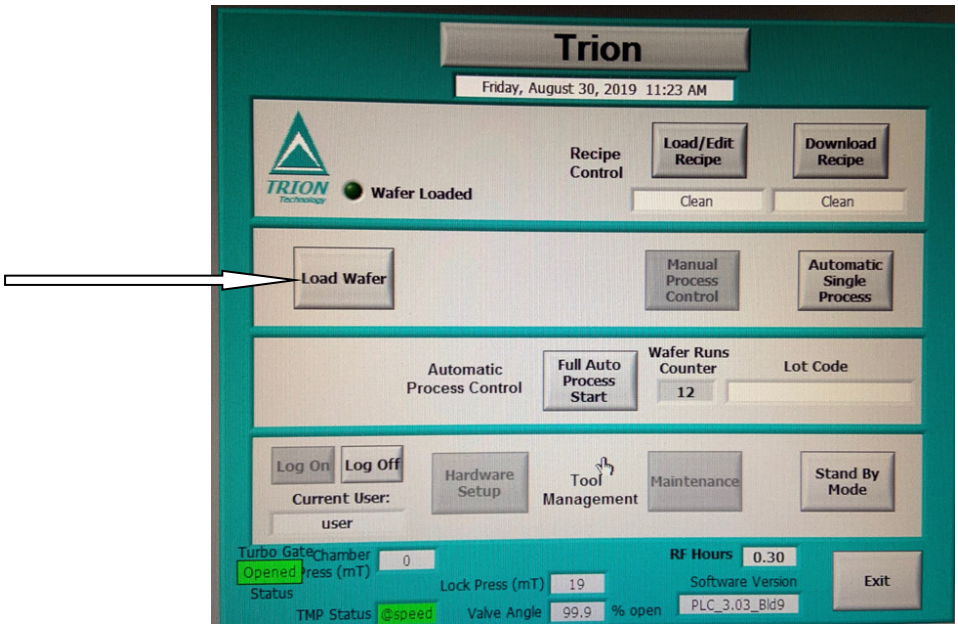
time by touching the process time and a numeric touch screen appears. If this is not the recipe you want to run, press RECIPE FROM DISC. This brings you to RECIPES FROM HARD DRIVE. Select the recipe you need and it will load the file. Type in the desired time for your etch in seconds, type in 5.0 for He Press, ensure Clamp On is Yes then press EXIT to load it into memory.

Note: Certain processes may require higher He flows to cool properly.

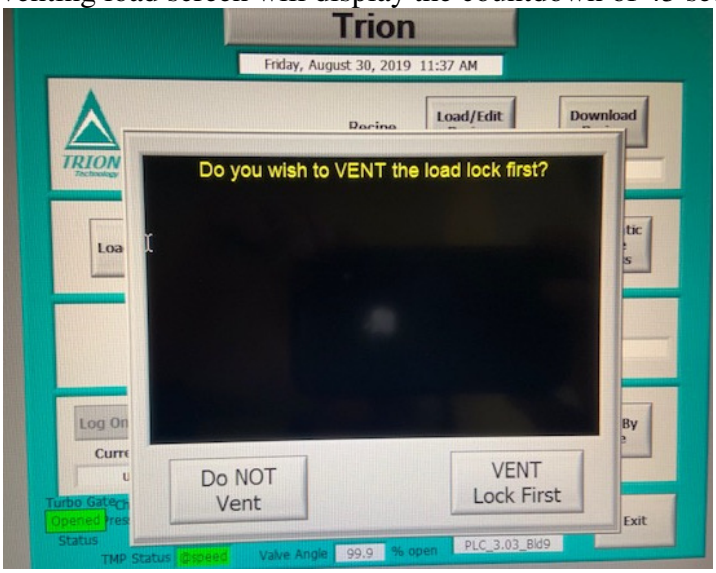




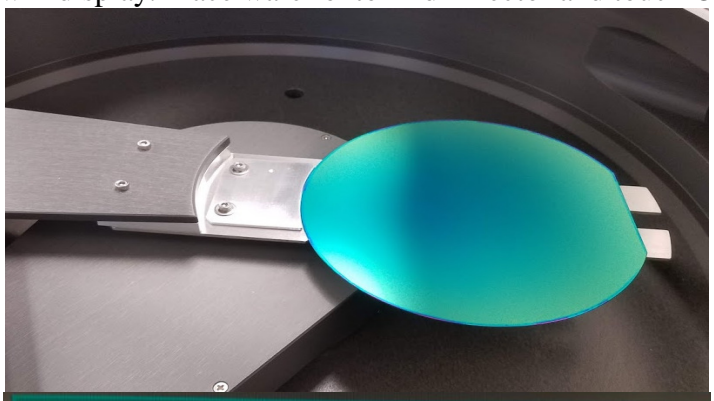
6.1.9 The MAIN Screen should appear with TRION at the top. To load a wafer without automatically starting the process, press LOAD WAFER.

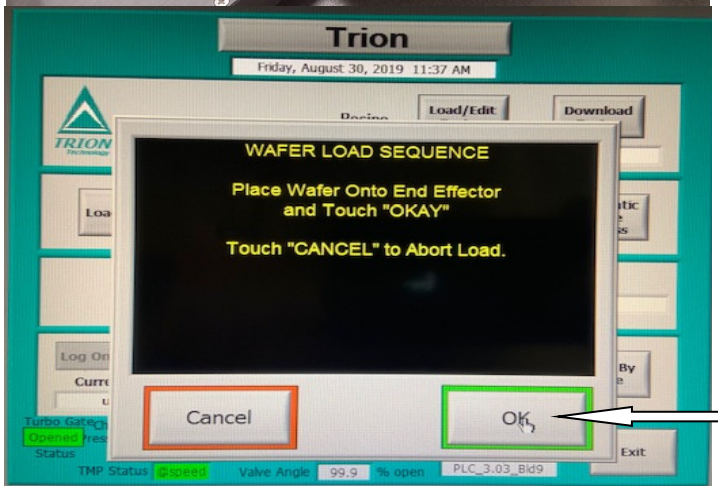


6.1.10 It will ask do you want to vent the load lock first, press VENT LOCK FIRST. The venting load screen will display the countdown of 45 seconds.



6.1.11 When vented the load lock will open and WAFER LOAD SEQUENCE screen will display. Place wafer onto End Effector and touch OKAY.

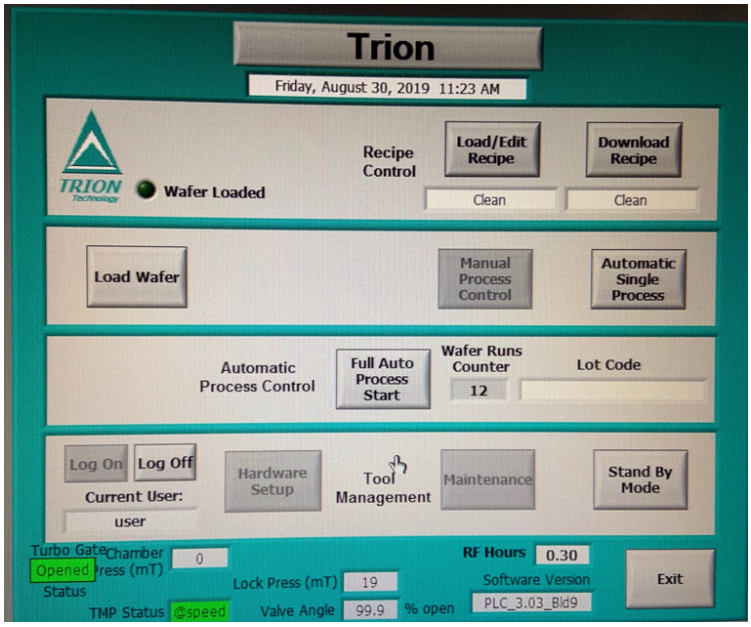




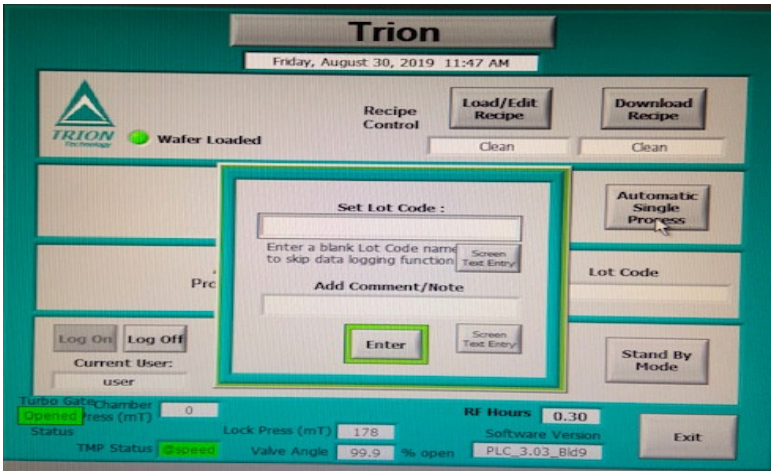
LID CLOSING screen appears followed by the WAFER LOAD SEQUENCE screen. Once the lock pressure reaches 350mT the wafer should load into the chamber. Once loaded it returns to the MAIN screen.

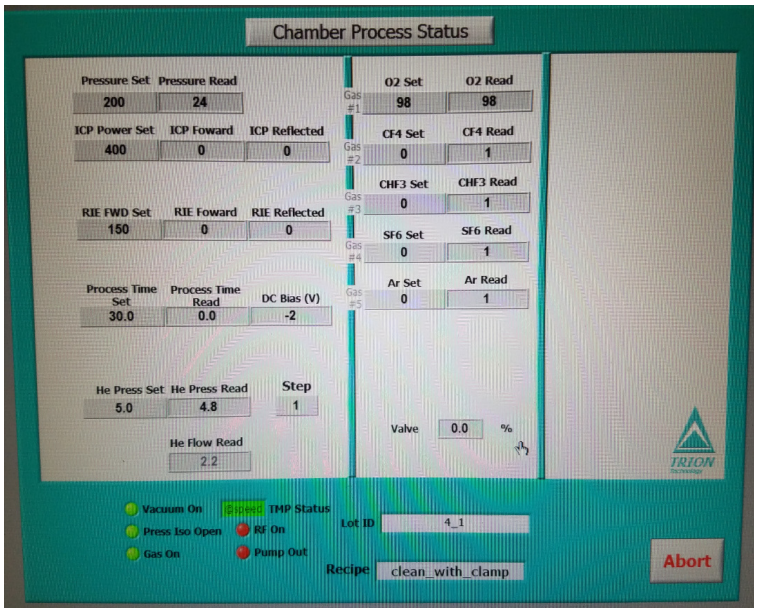
6.2 Etching a Wafer

NOTE: DO NOT ETCH WAFERS WITH PHOTORESIST THAT HAVE NOT BEEN HARD BAKED. CONTAMINATION, POOR FEATURE QUALITY AND BURNED RESIST MAY RESULT IF NOT HARD BAKED.

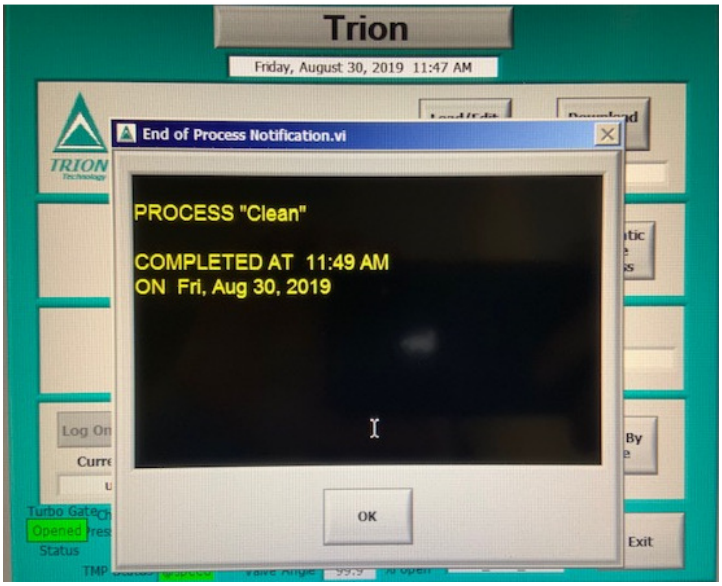


6.2.1 Press **AUTOMATIC SINGLE PROCESS.** If you use lot codes enter it. Press **ENTER (even if you entered nothing).** The Chamber Process Status Screen appears and runs the selected process.



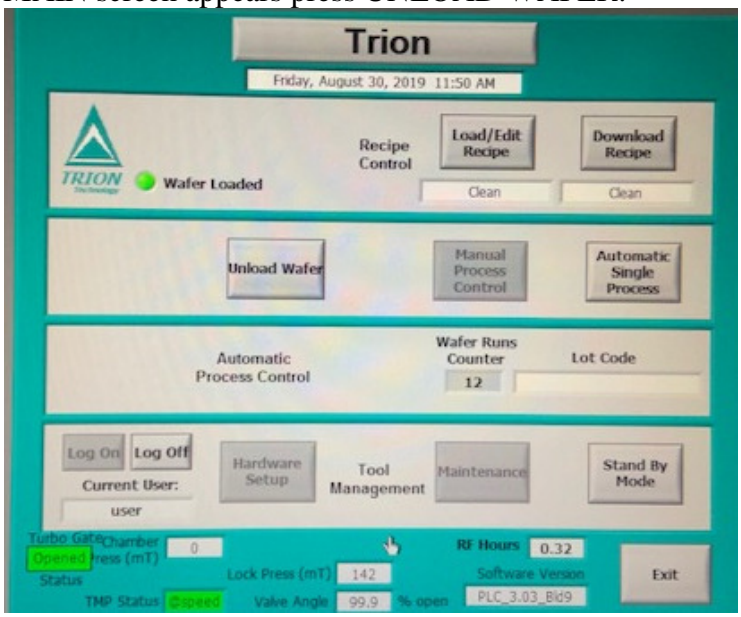


6.2.2 Press **OK** when the **END OF PROCESS NOTIFICATION** screen appears.



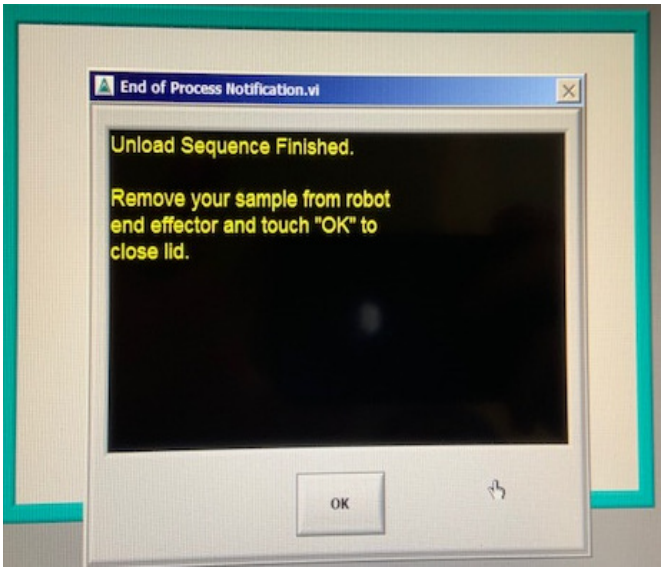
Note: When running in Automatic process control you do not have to do anything to de-clamp. The software will automatically turn on the HV output to the ESC as soon as the process starts. Then after the chamber reaches base pressure and the gases turn on, the helium will then begin flowing. When the process is done the software sets the ESC voltage supply to off but what this really does is run a program that is internal for the power supply. This routing is programmed to de-clamp the wafer. It shuts off the voltage, changes polarity, turns on the voltage for a few seconds and then cycles this once or twice more before issuing a shunt command to the controller. So you don't have to worry about the de-clamping. It runs automatically.

Once the MAIN screen appears press UNLOAD WAFER.

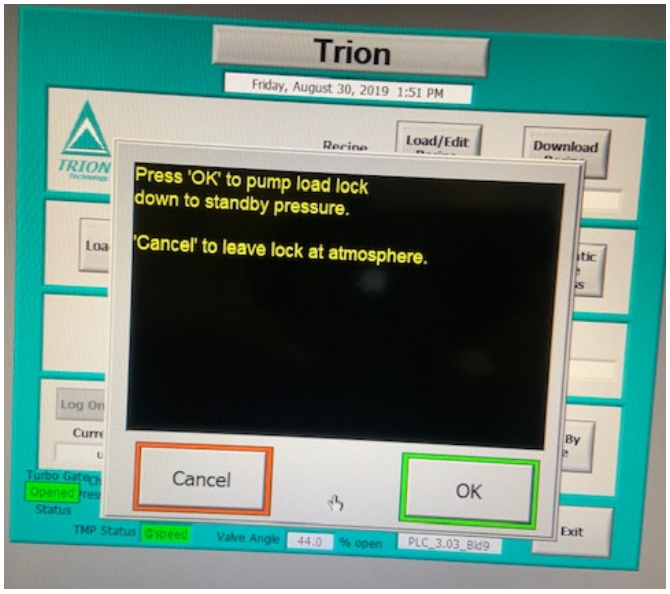


6.2.3 It will ask Do You Want to Vent the Load Lock, press OK. The WAFER UNLOAD screen will appear followed by the VENTING LOAD LOCK screen which counts down 45 seconds.

6.2.4 The chamber will open and the END OF PROCESS notification pops up. Unload your sample and load another if you are continuing to process.

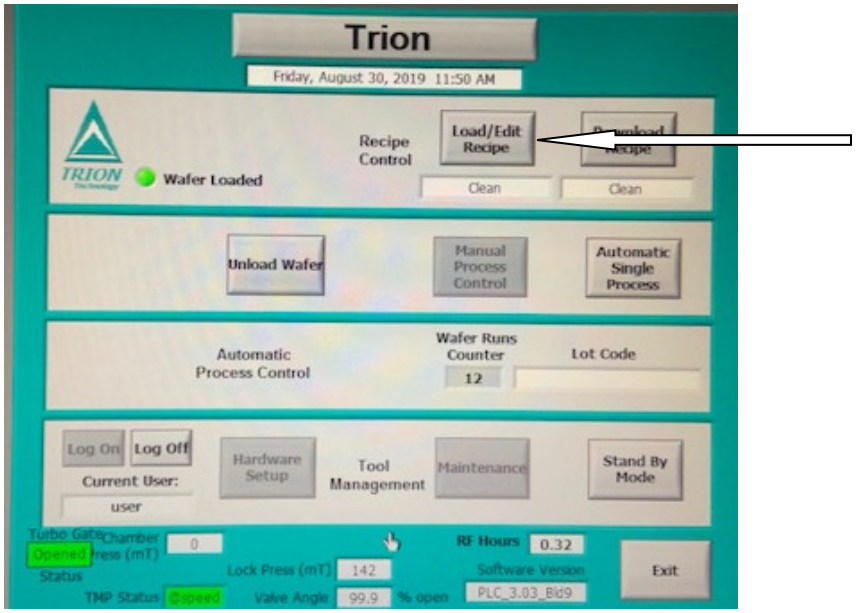


6.2.5 Press OK to close the lid then press OK to pump down the load lock. Repeat steps 6.2.1 through 6.2.6 if running more samples.

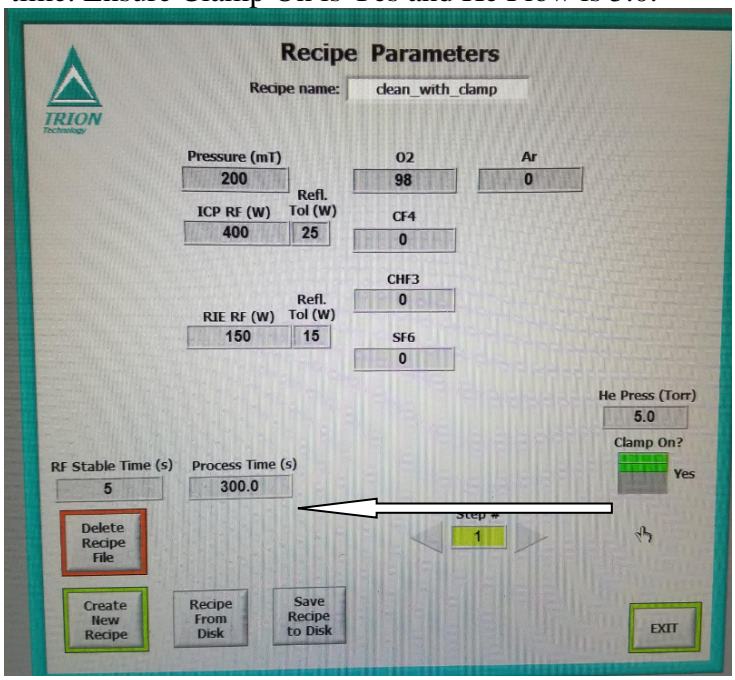


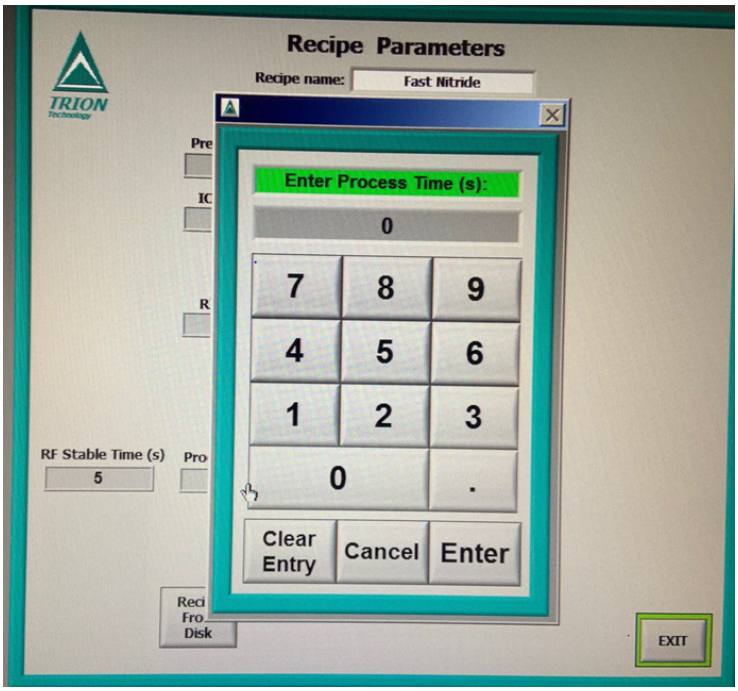
6.3 FULL AUTO MODE

6.3.1 Press LOAD/EDIT RECIPE

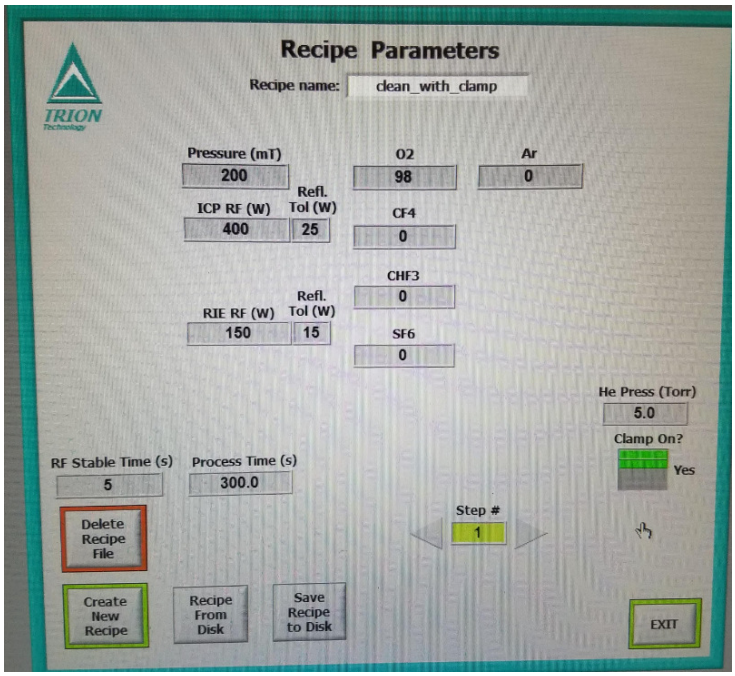


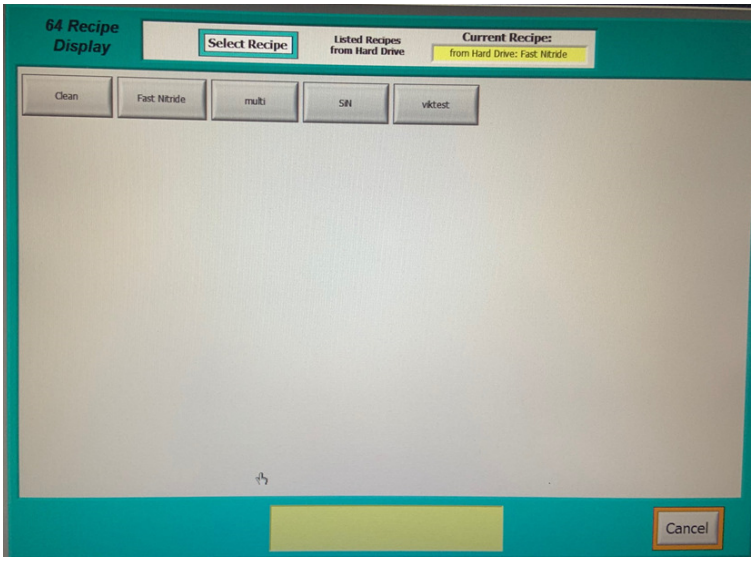
6.3.2 If the recipe you desire appears in the white block at the top of the screen edit your time by touching the time and a number pad will appear. Type in the correct etch time. Ensure Clamp On is Yes and He Flow is 5.0.





6.3.3 To change recipes press RECIPE FROM DISC and select the recipe desired. Edit the time for your etch as shown above.

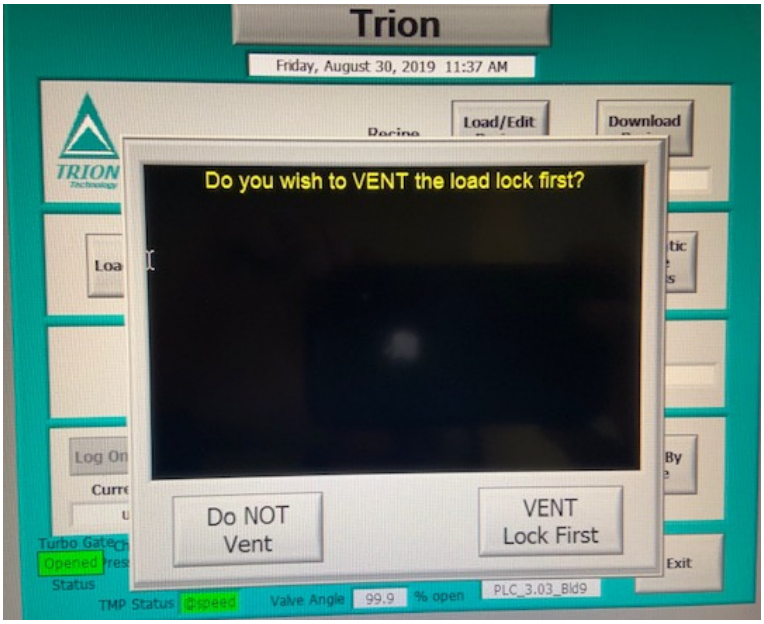




6.3.4 Press EXIT to load it into memory.

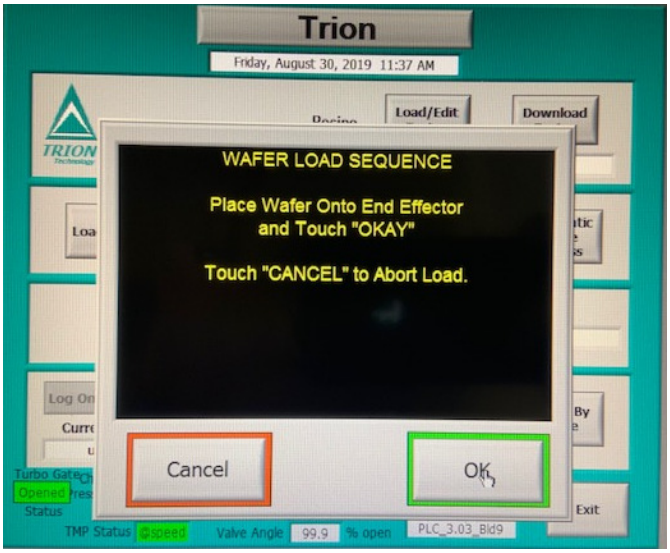
6.3.5 Press FULL AUTO PROCESS START.

6.3.6 Press VENT LOCK FIRST.



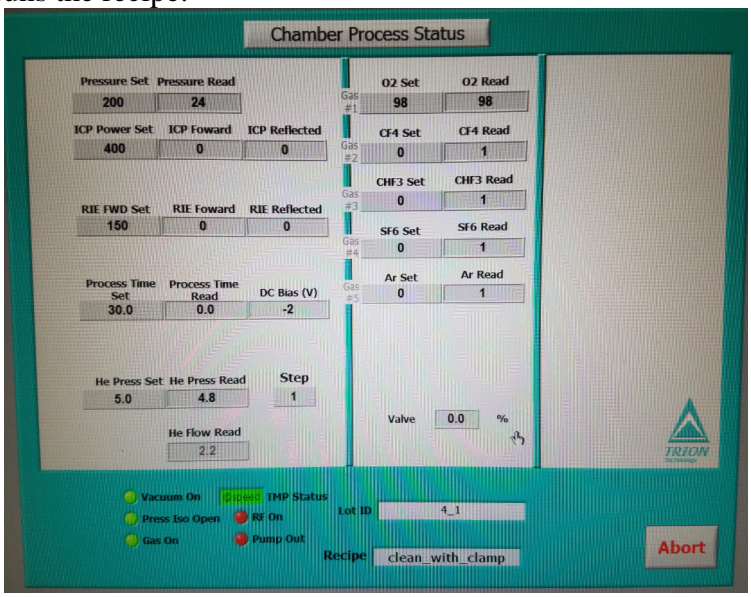
6.3.7 VENTING LOADLOCK screen will come on and the Lid will open.

6.3.8 At the WAFER LOAD SEQUENCE screen load your wafer on the end effector and press OK.

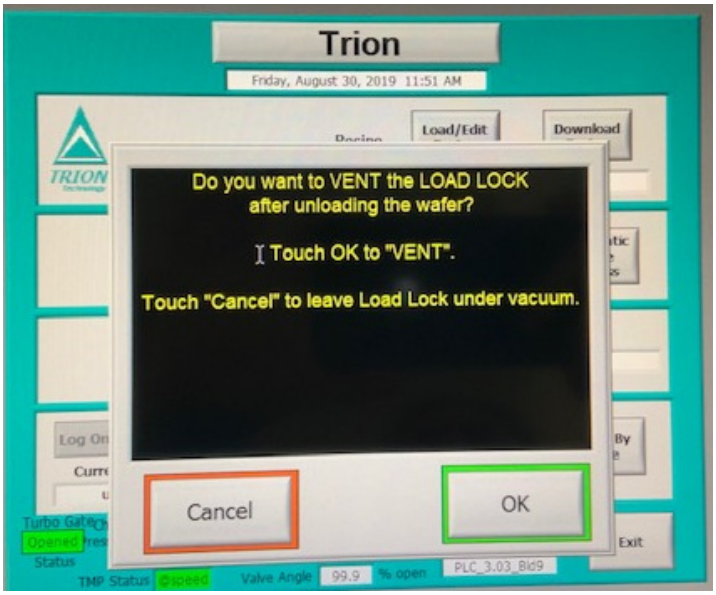


6.3.9 The CLOSING LID screen followed by the Wafer LOAD SEQUENCE screen will appear. When the load lock pressure reaches 350mT the gate valve will open and the wafer will load into the chamber.

6.3.10 The CHAMBER PROCESS STATUS screen now displays the process values as it runs the recipe.



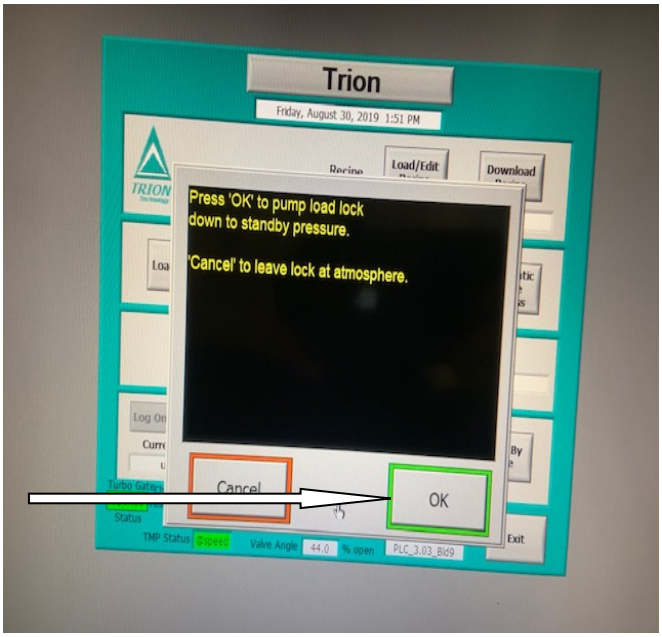
6.3.11 When the recipe is completed the question pops up DO YOU WANT TO VENT THE LOAD LOCK AFTER UNLOADING THE WAFER. Press OK.



6.3.12 The WAFER UNLOAD SEQUENCE followed by VENTING LOAD LOCK timer of 45 seconds runs. The lid will open.

6.3.13 The END OF PROCESS notification pops up. Remove your wafer and load another if applicable. When done press OK. It will close the load lock and ask

Press OK TO PUMP THE LOAD LOCK DOWN TO STANDBY PRESSURE.
Press OK.



6.3.14 If you loaded another wafer press FULL AUTO PROCESS START. Then answer Do NOT VENT THE LOAD LOCK.

6.4.15 On WAFER LOAD SEQUENCE screen Press OK. This will repeat the full auto process.

6.4 ENDING A RUN

6.4.1 Press LOG OFF

6.4.2 Press STANDBY MODE.

6.3.3 CARD SWIPE OUT

6.5 Errors during Run

6.5.1 Unknown at this time.

7 APPROPRIATE USES OF THE TOOL

7.1 This tool is only intended for 6” wafers and carriers.

7.2 Do not process wafers with gold or copper on them.

7.3 Etch Silicon Nitride and Polysilicon, silicon in Fluoride process only.

8 ATTACHMENTS

REVISION RECORD

Summary of Changes	Originator	Rev/Date
Original Issue	**Bruce Tolleson**	A-08/30/2019
Added Electrostatic Chuck with Helium Backside Cooling	Bruce Tolleson	B-06/02/2020